An Account of the TRANSIT OF VENUS *over the* SUN'S DISC, *as obſerved at* NORRITON, *in the County of* Philadelphia, *and Province of* Pennſylvania, June 3d, 1769.

By WILLIAM SMITH, *D. D. Provoſt of the College of* Philadelphia, JOHN LUKENS, *Eſq; Surveyor-General of* Pennſylvania, DAVID RITTENHOUSE, *A. M. of* Norriton, *and* JOHN SELLERS, *Eſq; Repreſentative in Aſſembly, for* Cheſter *County*-----

Being the Committee *appointed for that Obſervation, by the* AMERICAN PHILOSOPHICAL SOCIETY, *held at* Philadelphia, *for promoting uſeful Knowledge.*

Communicated to the SOCIETY, July 20*th*, 1769, *by Direction, and in Behalf of, the* Committee; *by Dr.* SMITH.

GENTLEMEN,

AMONG the various public ſpirited deſigns, that have engaged the attention of this *Society*, ſince its firſt Inſtitution; none does them more honor than their early reſolution to appoint COMMITTEES, of their own Members, to take as many obſervations, in different places, of that *rare Phænomenon*, the TRANSIT OF VENUS over the SUN'S DISC, as they had any probability of being able to defray the expence of, either from their own funds, or the public aſſiſtance they expected.

As the members of the *Norriton-Committee* live at ſome diſtance from each other, I am, therefore, at their requeſt, now to digeſt and lay before you, in one view, the whole of our obſervations in that place; diſtinguiſhing, however, the part of each obſerver; and going back to the firſt preparations. For I am perſuaded that the dependence, which the learned world may place on any particular Tranſit-Account,

will

will be in proportion to the previous and ſubſequent care, which is found to have been taken in a ſeries of accurate and well conducted obſervations, for aſcertaining the *going* of the time-pieces, and fixing the Latitude and Longitude of the places of obſervation, *&c.*

And I am the more deſirous to be particular in theſe points, in order to do juſtice to Mr. *Rittenhouſe*, one of our Committee; to whoſe extraordinary ſkill and diligence is owing whatever advantage may be derived, in theſe reſpects, to our obſervation of the *Tranſit* itſelf. It is further preſumed, that Aſtronomers, in diſtant countries, will be deſirous to have not only the work and reſults belonging to each particular *Tranſit-Obſervation*, but the materials alſo, that they may examine and conclude for themſelves. And this may be more particularly requiſite, in a New Obſervatory, ſuch as *Norriton*, the name of which hath perhaps never before been heard of by diſtant Aſtronomers; and therefore, its latitude and longitude are to be once fixed, from principles that may be ſatisfactory on the preſent, as well as on any future, occaſion.

Our great diſcouragement, at our firſt appointment, was the want of proper apparatus, eſpecially good *Teleſcopes*, with *Micrometers*. The generoſity of our *Provincial Aſſembly* ſoon removed a great part of this diſcouragement, not only by their vote to purchaſe one of the beſt Reflecting Teleſcopes, with a *Dollond*'s Micrometer; but likewiſe by their ſubſequent donation of *One Hundred Pounds*, for erecting Obſervatories, and defraying other incidental expences. It was foreſeen that on the arrival of this Teleſcope, added to ſuch private ones as might be procured in the city, together with fitting up the inſtruments belonging to the Honorable the Proprietaries of the Province, *viz.* the *equal Altitude* and *Tranſit Inſtrument*, and the large aſtronomical *Sector*, nothing would be wanting for the *City-Obſervatory* in the State-Houſe Square, but a good Time-Piece, which was eaſily to be procured.

We remained however ſtill at a loſs, how to furniſh the *Noritton Obſervatory*. But even this difficulty gradually vaniſhed.

Early

Early in *September*, 1768, ſoon after the nomination of our *Committees*, I received a letter from that worthy and honorable Gentleman, THOMAS PENN, Eſq; one of the Proprietaries of this Province, which he wrote at the deſire of the Rev. Mr. *Maſkelyne*, Aſtronomer Royal, expreſſing their deſire, " That " we would exert ourſelves in obſerving the Tranſit, for " which our ſituation would be ſo favourable" ; and encloſing ſome copies of Mr. *Maſkelyne*'s printed directions for that purpoſe.

THIS gave me an opportunity, which I immediately embraced, of acquainting Mr. PENN what preparations we had already made ; and what encouragement the Aſſembly had given in voting *One Hundred Pounds* Sterling, for the purchaſe of One Reflecting Teleſcope and Micrometer, for the City Obſervatory ; but that we ſhould be at a great loſs for a teleſcope of the like conſtruction for the *Norriton-Obſervatory*, and requeſting him to order a *Reflector* of two, or two and an half feet, with *Dollond*'s Micrometer, to be got ready as ſoon as poſſible in *London*. It was not long before I had the pleaſure to hear that Mr. PENN had ordered ſuch a Teleſcope, which came to hand about the middle of *May*, with a moſt obliging letter, expreſſing the ſatisfaction he had in hearing of the ſpirit ſhewn at *Philadelphia*, for obſerving this curious Phœnomenon when it ſhould happen ; and concluding as follows---

" I HAVE ſent, by Capt. *Sparks*, a Reflecting-Teleſcope with " *Dollond*'s Micrometer, exact to your requeſt, which I hope " will come ſafe to hand. After making your obſervation " with it, I deſire you will preſent it, in my name, to the Col- " lege---Meſſrs. *Maſon* and *Dixon* tell me, they never uſed a " better than that* which I formerly ſent to the Library Com-

* Mr. OWEN BIDDLE, who was appointed by the Society to conduct the obſervation near *Cape Henlopen*, had this teleſcope ; nothing being deſired there but the *contacts* and their exact time ; which he obtained to great ſatisfaction, as by his report may appear. As he had but ſhort time to prepare, and there was a difficulty in getting the neceſſary apparatus for fixing, by his own obſervations, the longitude and latitude of the place choſen for his ſtation, it was reſolved to depend on the aſcertaining theſe articles, by running a line from the place of his obſervation to a known point in the work of Meſſrs. *Maſon* and *Dixon*, when employed in ſettling the boundary lines of *Pennſylvania* and *Maryland* ; and in meaſuring a degree of latitude, along that fine level peninſula, between *Delaware* and *Cheaſopeake* Bays.

" pany

" pany of *Philadelphia*, with which a good obſervation may " be made, tho' it has no micrometer."

We were now enabled to furniſh the *Norriton* Obſervatory, as follows, *viz.*

1. A Gregorian Reflector about 2 f. focal length, with a *Dollond*'s Micrometer. This Teleſcope hath four different magnifying powers, viz. 55; 95, 130, and 200 times; by means of two Tubes containing eye-glaſſes that magnify differently, and two ſmall Speculums of different focal diſtances.
Made by *Nairne*. Uſed by Dr. Smith.

2. A Refractor of 42 f. its magnifying power about 140. The glaſſes were ſent from *London* with the large Reflector, and belonged to *Harvard* College, *New-England*; but as they did not arrive time enough to be ſent to that place before the Tranſit, they were fitted up here, by Mr. *Rittenhouſe*; and----
Uſed by Mr. Lukens.

3. Mr. *Rittenhouſe*'s Refractor, with an object glaſs of 36 f. focus, and a convex eye-glaſs of 3 inches, magnifying about 144 times. Uſed by Himself.

Both theſe Refractors, as well as the Reflector, were in moſt exquiſite order.

4. An *Equal-Altitude Inſtrument*; its teleſcope three and an half f. focal length, with two horizontal hairs, and a vertical one, in its focus, firmly ſupported on a ſtone pedeſtal, and eaſily adjuſted to a plummet wire 4 feet in length, by 2 ſcrews; one moving it in a North and South, the other in an Eaſt and Weſt, direction.

5. A Transit-Telescope, fixed in the *Meridian* on an axis with fine ſteel points; ſo that the hair in its focus can move in no other direction than along the meridian; in which are two marks South and North, about 330 yards diſtance each; to which it can be readily adjuſted in a horizontal poſition by one ſcrew, as it can in a vertical poſition by another ſcrew.

6. An

6. An excellent Time-Piece, having for its pendulum-rod a flat ſteel-bar, with a *bob* weighing about 12 lb. and vibrating in a ſmall arch. It goes 8 days, does not ſtop when wound up, beats dead ſeconds, and is kept in motion by a weight of 5 pounds.

These three laſt articles were alſo Mr. *Rittenhouſe*'s property, and made by himſelf.

7. An Astronomical Quadrant, two and an half f. radius, made by *Siſſon*, the property of the *Eaſt Jerſey* Proprietors; under the care of the Right Hon. *William* Earl of *Stirling*, Surveyor-General of that Province; from whom Mr. *Lukens* procured the uſe of it, and ſent it up to Mr. *Rittenhouſe* for aſcertaining the latitude of the Obſervatory. Thus we were at length compleatly furniſhed with every inſtrument proper for our work.

As Mr. *Rittenhouſe*'s dwelling at *Norriton* is about 20 miles North-Weſt of *Philadelphia*, our other engagements did not permit Mr. *Lukens* or myſelf, to pay much attention to the neceſſary preparations; but we knew that we had entruſted them to a gentleman on the ſpot, who had joined to a compleat ſkill in *Mechanics*, ſo extenſive an *aſtronomical* and *mathematical* knowlege, that the uſe, management, and even the conſtruction, of the neceſſary apparatus, were perfectly familiar to him. Mr. *Lukens* and myſelf could not ſet out for his houſe till *Thurſday*, *June* 1ſt; but, on our arrival there, we found every preparation ſo forward, that we had little to do, but to examine, and adjuſt our reſpective teleſcopes to diſtinct viſion. He had fitted up the different inſtruments, and made a great number of obſervations, to aſcertain the going of his Time-Piece, and to determine the latitude and longitude of his *Obſervatory*. The laudable pains he hath taken in theſe material articles, will beſt appear from the work itſelf, which he hath committed into my hands, with the following modeſt introduction; giving me a liberty, which his own accuracy, care and abilities, leave no room to exerciſe.

Nor-

Norriton, July 18, 1769

DEAR SIR

" *THE incloſed is the beſt account I can give of the* CONTACTS, *as I obſerved them; and of what I ſaw during* " *the interval between them. I ſhould be glad you would contract* " *them, and alſo the other papers, into a ſmaller compaſs, as I* " *would have done myſelf, if I had known how. I beg you would* " *not copy any thing merely becauſe I have written it, but leave out* " *what you think ſuperfluous.*

I am,

With great eſteem and affection,

Yours, &c.

DAVID RITTENHOUSE."

To Revd. Dr. SMITH.

Mr. RITTENHOUSE'*s Obſervations at* Norriton, *before and after the* TRANSIT OF VENUS, June 3d, 1769; *for fixing the Latitude and Longitude of his Obſervatory, and the going of his Clock*, &c.

" EARLY in *November*, 1768, I began to erect an " *Obſervatory*, agreeable to the reſolutions of the AME- " RICAN PHILOSOPHICAL SOCIETY; but, thro' various diſap- " pointments from workmen and weather, could not com- " pleat it, till the middle of *April*, 1769. I had for ſome " time expected the uſe of an *Equal Altitude* inſtrument " from *Philadelphia*; but finding I could not depend on " having it, I fell to work, and made one of as * ſimple a " conſtruction as I could. *March* 20th this inſtrument was " finiſhed, and put up out of doors, the Obſervatory not " being yet ready.

* *It is deſcribed above, No.* 4, *of the Apparatus.*

" I HAD, however, for ſome weeks before this, with my " 36 f. Refractor, obſerved eclipſes of Jupiter's ſatellites, in " ſuch a manner that, tho' my equal-altitude inſtrument was " not finiſhed, and conſequently I could not ſet my time- " piece to the true noon, I ſhould nevertheleſs be able to tell " the time of thoſe eclipſes afterwards, when the inſtrument " ſhould be ready For this purpoſe, I obſerved, almoſt eve- " ry fair evening, the time by the clock, when the bright ſtar " in Orion diſappeared behind a fixed obſtacle, by applying " my eye to a ſmall ſight-hole, made thro' a piece of braſs, " faſtened to a ſtrong poſt.

THE Obſervations were as follows, *viz.*

1769. Star diſappear'd. per clock.			Immer. 1ſt ſatel. per clock.				Equal altitudes of ☉				Hence appar. noon, or ☉'s cent. on Merid. per clock.
Feb. D.	h	m. ſec.	*Feb* D.	h.	m. ſec.		*Mar.* D.	*A. M.* h. m. ſec.	*P. M.* h. m. ſec.		h m. ſec.
15	9.	26. 39	16	1.	24. 58		19	8. 58. 52.	2. 56 52		11. 57. 37
22	8.	58. 52	23	16.	17. 41			9. 2. 12.	2. 53. 32		
24	8.	50. 57					20	8. 56. 40	2. 58. 26		11. 57. 18
Mar. 3	8.	23. 21	Hence, from column 3d. the apparent times of the immerſions above, are,					8. 59. 59.	2. 55. 7		
12	7.	48. 26									
14	7.	40. 41									
17	7	29. 4									
20	7.	17. 16									
21	7.	13. 21	*Feb.* D.	h	m. ſec.						
28	6.	45. 44	16	4	21. 10						
			23	16.	15. 1						

" FROM this time, to *May* 20th, the clock was altered " ſeveral times; once taken down and cleaned, removed back " to the Obſervatory, and regulated anew. Care was, how- " ever, taken to obſerve *equal-altitudes* of the Sun, on the " days preceeding and following any viſible eclipſe of the 1ſt " ſatellite; when the weather would permit.

" THE whole obſervations, during this period, were the " following.

Equal

Equal Altitudes of ☉ *April* 3d, 1769.		Hence appar. noon: or ☉'s cent. on Merid. per clock.	Observed Immersions of 1st Satellite.
A. M. h. m. sec.	*P. M.* h. m. sec.	h. m. sec.	
8. 5. 22	4. 1. 56	12. 3 25	*April* 3d.
8. 8. 16	3. 59. 2		h. m. sec.
			14. 52. 40
4th.			
8. 3. 43	4. 3. 3	12. 3. 9	
8. 6. 38	4. 0. 10		
10th.			10th.
8. 32. 8	Cloudy.		16. 46. 20
8. 35. 6			Day-Light.
8 36. 31			
11th.			
8. 30. 22	3. 30 43		
8. 33. 18	3. 27. 47	12. 0. 20	
8. 34. 41	3. 26. 22		
12th.			12th.
8. 28 55			
8. 31. 51	Cloudy.		11. 14. 38
8. 33. 16			
14th.			
8. 25. 42	3. 33. 56		
Cloudy.	3. 31. 1	11. 59. 38	
8. 30. 2	3. 29. 37		
May 4th.			
8. 5. 15	3. 44. 6		
8. 8. 3	3. 41. 18	11. 54. 32	
8. 9. 23	3. 39 58		
5th.			*May* 5th.
8. 4. 11	3. 44. 51		11. 23. 45
8. 6. 59	3. 42. 4	11. 54. 22	
8. 8. 19	3. 40. 42		
6th.			
8. 3. 8	3. 45. 37		
8. 5. 54	3. 42. 51	11. 54. 14	
8. 7. 15	- - - -		
11th.			
8. 34. 51	3. 17. 12		
8. 36. 13	3. 15. 49		
8. 37 40	3. 14. 22	11. 55. 54	
8. 39. 3	3. 12. 59		
15th.			*May* 14th.
9. 12. 59	2. 39. 28		Emersion.
- - - -	2. 38. 2	11. 56. 7	9. 58. 20
9. 15. 53	2. 36. 32		
- - - -	2. 35. 7		

" MAY 20th, in the morning, the clock was ſet up for the laſt " time, pretty near the mean time. It had no proviſion for pre- " venting the irregularities ariſing from heat and cold; nor could " I find leiſure to apply any contrivance of this ſort.

" THIS day I likewiſe put wires inſtead of hairs in the teleſcope " of the equal altitude inſtrument; and the following are the ob- " ſervations, taken both with it, and with the meridian or *Tranſit-* " *Teleſcope*, in the order wherein they were made.

" THE ill ſtate of my health would not permit me to ſit up at " nights, to take equal altitudes of the ſtars. I was therefore " obliged to content myſelf with thoſe of the Sun only.

1769.				
		May 20th.		
Equal Altitudes of ☉ *A. M.* *P. M.* h. m. ſec. h. m. ſec 8. 1. 30* 3. 51. 28 8. 2. 52 3. 50. 8 8. 4. 15 3. 48. 45 8. 5. 36 3. 47. 24	Hence appar. noon; or ☉'s cent. on Merid. per clock. h. m. ſec. 11. 56. 23¾	Obſerv'd Emerſions of 4's Satellites.	Obſervations with the Meridian Teleſcope. h. m. ſec. ☉ W. limb } 11. 55. 16 on Merid. } Eaſt Do. 11. 57. 31	Hence appar. noon; or ☉'s cent. on Merid. per clock. h. m. ſec. 11. 56. 23½
		May 21ſt.		
8. 1. 1 3. 52. 11 Clouds. } 3. 50. 50 3. 49 27 3. 48. 7	11. 56. 30	Em. 1ſt Sat. h. m. ſec. 11. 51. 46.	☉ W. limb, 11. 55. 23 E. Do. 11. 57. 37 ♀ centre } 1. 18. 39 on Merid. }	11. 56. 30
		May 23d.		
8. 0. 4 3. 53. 36 8. 1. 24 3. 52. 16 8. 2. 47 3. 50. 53 8. 4. 8 - - -	11. 56. 45		☉ W. limb 11. 55. 39 E Do. 11. 57. 53	11. 56. 46
		May 24th.		
			☉ E. limb, 11. 58. 0 — paſſ. ☉ ſemidi. 1. 8 ♀ centre } 1. 2. 4 ditto, }	11. 56. 52
		May 25th.		
7. 59. 15 3. 54. 57 8. 0. 35 3. 53. 38 8. 1. 58 3. 52. 15 8. 3. 18 3. 50. 54	11. 57. 1		☉ W. limb 11. 55. 53 E. Do. 11. 58. 9	11. 57. 1

* In the above Equal Altitudes, it may be proper to obſerve that thoſe in the afternoon are ſet down in an inverted order, the 4th P. M. being oppoſite and correſponding to the 1ſt A. M. The 1ſt ſett, according to the order in which they ſtand, is the Sun's upper limb at upper hair; the 2d is the upper limb at lower hair; the 3d the lower limb at upper hair; and the 4th the lower limb at lower hair, as the teleſcope inverts.

May 26th,

1769. *May 26th.*

Equal Altitudes of ☉		Hence apparent noon; or ☉'s cent. on Merid. per clock.	Obſerved Emerſions of ♃'s Satellites.	Obſervations with the Meridian Teleſcope.	Hence apparent noon; or ☉'s cent. on Merid. per clock.
A. M.	*P. M.*				
h. m ſec.	h. m. ſec.	h. m. ſec.		h. m. ſec.	h. m. ſec.
7. 58.54	3.55. 38				
8. 0.15	3.54. 18				
8. 1.37	3.52. 56			☉ W. limb 11.56. 3	
8. 2.57	3.51. 35	11. 57. 10		E. ditto, 11.58. 18	11. 57. 10½

May 27th.

				☉ w. limb 11.56. 12 E. Do. 11.58. 27	11. 57. 19½

May 30th.

				☽ E. limb on Merid. } 20.20.31	

May 31ſt.

7 57.29	3.58. 49				
7.58.49	3.57. 30	h. m. ſec.		☉ W. limb 11.56. 58	
8. 0.11	3.56. 8	11. 58. 5½		+ paſſ. ☉ ſemidi. 1. 8	11. 58. 6
8. 1.31	3.54. 49				

June 2d.

Put ſmaller wires in the Teleſcope; hence the difference of the intervals.					
7.57. 9	4. 0. 6				
7.58.29	3.58. 47	11. 58. 34		☉ W. limb 11.57. 26 E. Do. 11.59.41	11. 58. 33½
7.59.53	3.57. 22				
8. 1.13	3.56. 3				

June 3d.

TRANSIT DAY. Equal altitudes were not taken this day, as the inſtrument was to be otherwiſe employed in the afternoon.				☉ W. limb 11.57.41 E. Do. 11.59.57	11. 58. 49

June 4th.

- -	4. 1. 18				
7.58.10	3.59. 59	11. 59. 1½		☉ W. limb 11.57.54 E. Do. 12. 0.10	11. 59. 2
7.59.34	3.58. 35				
8. 0.54	3.57. 15				

June 5th.

1769. *June 5th.*

Equal Altitudes of ⊙		Hence apparent noon; or ⊙'s cent. on Merid. per clock.	Observed Emersions of 4's Satellites.	Observations with the Meridian Teleſcope.	Hence apparent noon; or ⊙'s cent. on Merid. per clock.
A. M.	*P. M.*				
h, m ſec.	h, m. ſec.	h. m. ſec.			
7.56.43	4. 1. 50	11. 59. 13½			
7.58. 3	4. 0. 30				
7.59.27	3.59. 7				
8. 0.47	3.57.47				

June 6th.

- - -	2.50.12	11. 59. 26	Em. 1ſt Sat.	h. m. ſec.	h m. ſec.
- - -	2.48.51		h. m. ſec.	⊙ W. limb 11.58.18	11. 59. 25½
9.11.30	2.47.26		10. 11. 2	E. Do. 12. 0. 33	

June 7th.

7.57.52	4. 1. 25	11. 59. 36	Em. 2d. Sat.	⊙ W. limb 11.58. 27	11. 59. 35½
7.59.16	4. 0. 1		8. 23. 42	E. Do. 12. 0. 44	
8. 0.35	- - -			☽ W. limb on Merid. 3.21. 53	

June 8th.

7.56.27	4 3. 12	11. 59. 48		⊙ W. limb on Merid. 11.58.40	11. 59. 48½
7.57.48	4. 1. 52			E. Do. 12. 0. 57	
7.59.10	4. 0. 28				
8. 0.32	3.59. 7				

June 10th.

7.56.22	4. 4. 1	12. 0 9½			
7.57.48	4. 2. 41				
7.59.12	4. 1. 17				
8. 0.32	3.59. 7				

June 12th.

				⊕ W. limb 11.59.29	12. 0. 37
				E. Do 12. 1.45	

June 13th.

7.59.13	4. 2. 30	12. 0 50	Em. 1ſt Sat	⊕ W. limb 11.59.42	12. 0. 50½
8. 0.33	4. 1. 11		12. 5. 59	E. Do. 12. 1 59	

June 14th

				⊕ W. limb 11.59 57	12. 1. 5
				E. Do. 12. 2.13	

June 16th.

7.56.52	4. 6. 16	12. 1. 34		⊕ W. limb 12. 0. 26	12. 1. 34
7.58.12	4 4. 57			E. Do. 12 2. 42	
7.59.36	4. 3. 33			4 cent. on Merid. 9 6. 4	
8 0.56	4. 2. 12				

June 17th.

1769			*June* 17*th*.	
Equal Altitudes of ☉ *A. M.* *P. M.*	Hence apparent noon; or ☉'s cent. on Merid. per clock.	Observed Emersions of ♃'s Satellites.	Observations with the Meridian Teleſcope. h. m. ſec.	Hence apparent noon; or ☉'s cent. on Merid. per clock. h. m. ſec.
			☉ W. limb 12. 0. 36 + paſſ. ſemid. 1. 8,8 ♃ centre on Merid. 9. 1 50	12. 1 44 8 Thermometer 77°
			June 19*th*.	
			☉ W. limb 12. 0. 56 + paſſ ſemidi. 1. 8,8 ♃ c. on mer. 8. 53. 24	12. 2. 4,8 Therm. 77°.
			June 21*ſt*.	
			☉ W. limb 12. 1. 17 E. Do 12. 3. 34	12. 2 25½ Therm. 83°
			June 22*d*.	
			☉ W. limb 12. 1. 28 E. Do. 12. 3. 45	12. 2 36⅓ Therm. 74°½
			June 23*d*.	
			☉ W. limb 12. 1. 39 E. Do. 12. 3. 55	12. 2 47 Therm 73°½
			June 24*th*.	
			☉ W. limb 12. 1. 49 E. Do. 12. 4 5	12. 2. 57 Therm 84°.
			June 25*th*.	
		3d ſat. out of the ſhadow, on applying the eye at 8. 54. 39	☉ W. limb 12. 1. 57 E. Do. 12. 4. 14	12. 3. 5½ Therm. 80°.
			June 26*th*.	
			☉ W. limb 12. 2. 6 E. Do. 12. 4. 23 ☽ E. limb on Merid. 18. 13. 52	12. 3. 14½ Therm. 85°
			June 27*th*	
			☉ W. limb 12 2. 14 E Do 12 4. 31 ☽ E. limb on Merid. 19. 4. 19 ♃ c on mer. 8. 19 58	12. 3. 22 Therm. 88°.

June 28*th*.

1769. *June 28th.*

Equal Altitudes of ☉		Hence apparent noon; or ☉'s cent. on Merid. per clock.	Observed Eclipses of 4's Satellites.	Observations with the Meridian Teleſcope	Hence apparent noon; or ☉'s cent. on Merid. per clock.
A. M.	*P. M.*				
h. m. ſec.	h. m. ſec.				
7. 59. 11	4. 7.45				
8. 0. 31	4. 6.25				
8. 1. 55	4 5. 0	h. m ſec.		h. m. ſec.	h. m. ſec.
8 3.15	- - -	12. 3 29,4		☉ W. limb 12. 2. 21 E. Do. 12. 4.38	12 3. 29½

June 29th.

- - -	4. 7.43		Em. 1ſt Sat. having been hid by a cloud, at h. m. ſec. 10 25. 1		
8. 0.48	4. 6.22	12. 3. 37		☉ W. limb 12. 2.29 E. Do, 12. 4.45	12. 3. 37
8. 2.11	4. 4.59				*June 30th*
8. 3.32	4. 3.38				Therm. 85°.

July 2d.

8. 0.24	4. 7.28		Immerſion. 3d Satellite. 11. 19. 36		
8. 1.44	4. 6. 8	12. 3. 59		☉ W. limb 12. 2.52 E. Do. 12. 5. 8	12. 4. 0
8. 3. 8	4. 4.43				Therm. 81°½
8. 4.29	- - -				

July 3d.

8. 0.46	4. 7.21				
8. 2. 7	4. 5.58	12. 4. 6		☉ W. limb 12. 2.58 E. Do. 12. 5.15	12. 4. 6½
8. 3.31	4. 4.37				Therm. 83°.
8. 4.51	4. 3.16				

July 4th.

8. 1. 9	4. 7.13				
8. 2.30	4. 5 52	12. 4. 14		☉ W limb 12. 3. 6 E. Do. 12. 5.23	12. 4. 14½
8. 3 53	4. 4 31				Therm. 87°
8. 5 14	4. 3.10				

July 5th.

8. 5.36	4. 2.57	12. 4. 19,3		☉ W. limb 12. 3. 11 +paſſ. ſemidi. 1. 8,5	12. 4 19½ Ther.) at)94°½ 3P.M.)

July 8th.

8. 1.36	4. 7.41			☉ W. limb 12. 3 36	
8. 2.56	4. 6.20	12. 4. 42.½		E. Do. 12. 5 52	12. 4. 44
8. 4.19	4. 4.57				Therm 82°½

TABLE

TABLE *of the Eclipſes of Jupiter's 1ſt Satellite, obſerved at* NORRITON, *from February 16th to June 13th; compared with the* calculated *Times of the ſame Eclipſes, for Greenwich, in order to fix the Longitude of the Obſervatory. The Immerſions were obſerved with Mr.* Rittenhouſe's *Refractor, and the Emerſions with the Gregorian Reflector.*

1ſt. Sat. *Immerſions.* 1769. Apparent Time at *Norriton.*				Calculated apparent time of the ſame at *Greenwich.*				Longitude of *Norriton* W. from *Greenwich*; thence deduced.		
	D.	h.	m.	ſec.	D.	h.	m.	ſec.	h.	m.	ſec.
Feb.	16	14.	21.	10	*Feb.* 16	19.	22.	29	5.	1.	19
	23	16.	15.	1	23	21.	16.	35	5.	1.	34
April	3	14.	49.	25	*April* 3	19.	51.	24	5.	1.	59
	10	16.	46.	0	10	21.	47.	14	5.	1.	14
	12	11.	14.	37	12	16.	16.	13	5.	1.	36
May	5	11.	29.	27	*May* 5	16.	31.	20	5.	1.	53
		Emerſions.				Emerſions.					
	21	11.	55.	13	21	16.	56.	49	5.	1.	36
June	6	10.	11.	32	*June* 6	15.	1[illegible].	59	5.	1.	27
	13	12.	5.	1	13	17.	6.	31	5.	1.	30

Diff. of Longitude from a Mean of the above 9 Eclipſes 5. 1. 34,22

which we muſt fix for the Longitude of our Obſervatory, for the preſent.

But ſhould the obſerved * times of thoſe Eclipſes, come out different at Greenwich from their calculated times in the nautical almanac, for the preſent year, a correction of the difference of longitude muſt be made accordingly. OBSER-

* Since drawing up the above, the Revd. Mr. Maſkelyne, Aſtronomer Royal, agreeable to my requeſt, hath been pleaſed to communicate the following liſt of Eclipſes of Jupiter's 1ſt Sattellite as obſerved at the Royal Obſervatory, from April to June, both incluſive, viz.

1769.	D.	h.	m.	ſec.	Immerſions of 1ſt Sat. at Greenwich.
March	29	12.	25.	7	with 2 f. Reflect. made by *Short*; Apert. 4, 5 inches diam.
April	12	16.	16.	8	with 2 f. Reflect. made by *Bird*; Apert. 3, 8 inches diam.
	28	14.	35.	17	with *Short*'s 2 f. Reflector.
		Emerſions.			
May	16	9.	32.	15	with *Short*'s 2 f. Reflector.
		9	31.	35	with 6 f. Newtonian Reflector; Aperture 9 inches diam.
June	8	9.	40.	56	with 6 f. Ditto.
	15	11.	35.	33	with *Short*'s 2 f. Reflector.
July	1	9.	50.	24	with Ditto.

Mr. Maſkelyne writes that the 6 f. Reflector ſhews an immerſion later and an emerſion ſooner than Short's 2 f. Reflector by about 20″; and that the difference of the 2 f. Reflectors, owing to the difference of their apertures, may be about 5″.

There are only three of the above eclipſes obſerved at Greenwich, (viz. the 3 immerſions) that could have been ſeen here, and but one of them happens to be among thoſe actually obſerved, viz.

April 12th 16h. 16′. 8″ at *Greenwich.*
11. 14. 37 at *Norriton.*

Hence 5. 1. 31 Difference of Longitude.

Till we have an opportunity, the enſuing ſpring, to obſerve more eclipſes of Jupiter's Satellites, we would rather depend on the difference of longitude de-

duced

OBSERVATIONS *for fixing the* LATITUDE *of* Norriton-Obſervatory, *with an Aſtronomical-Quadrant of two and an half feet radius; made by* Siſſon.

THIS Quadrant was ſent up by Mr. *Lukens*, and erected in the meridian of the Obſervatory, *May* 20th, by Mr. *Rittenhouſe*; who took the following Obſervations with it; *viz.*

ZENITH diſtances of Stars, for diſcovering whether there might be any error in the inſtrument.

With the face of the Quadrant weſtwards.				With the face eaſtwards.			
Higheſt ſtar in left leg of Bootes	*May* 31	20°. 36′. 6″		Higheſt ſtar in left leg of Bootes	*June* 6	20°. 35′. 55″	
	June 4	20. 36. 0			7	20. 35. 54	
	5	20. 36. 0			8	20. 36. 0	
Arcturus	*May* 31	19. 46. 18		Arcturus	*June* 6	19. 46. 5	
	June 1	19. 46. 14			7	19. 46. 8	
	2	19. 46. 20			8	19. 46. 13	
	5	19. 46. 22			10	19. 46. 11	
Bright ſtar in the Crown	*June* 1	12. 39. 36		Bright ſtar in the Crown	*June* 6	12. 39. 34	
	5	12. 39. 27			10	12. 39. 18	

FROM a mean of the above 18 Obſervations, the error of the quadrant is 3,″5 to be *ſubſtracted* from the Zenith diſtance when the face is weſtwards, and *added* when it is eaſtwards.

OBSERVATIONS *of the Zenith Diſtance of the Sun's upper and lower Limb; and the Latitude of the Obſervatory deduced from each ſeparately.*

☉'s upp. limb *à* Zen.	Hence Lat.	☉'s low. limb *à* Zen.	Hence Lat.
May 25. 18° 48′. 45″	40°. 10′. 17″	*June* 8. 17°. 29′. 33″	40°. 9′. 48″
26. 18. 38. 18	40. 10. 10	9. 17. 24. 35	40. 9. 47
27. 18. 28. 21	40. 10. 10	10. 17. 20. 5	40. 9. 49
June 1. 17. 43. 47	cloudy, and doubtful.	11. 17. 15. 59	40. 9. 52
2. 17. 36. 16	40. 10. 2	14. 17. 6. 9	40. 9. 58
4. 17. 21. 51	40. 9. 52		
doubtf. 6. 17. 8. 53	40. 9. 34		
7. 17. 3. 21	40. 9. 47		
12. 16. 41. 10	40. 10. 14		
13. 16. 37. 45	40. 10. 8		

Mean of the above 9 obſervations of ☉'s upper limb is, 40°. 10′. 1″. 33‴

Do. from the 5 obſervations of lower limb, 40. 9. 50. 48

Mean of both, 40°. 9′. 56.″10‴

And 39. 56. 54.

Mean of the 5 obſervations of the lower limb, 40°. 9′. 50″. 48‴

for the Lat. of *Norriton* Obſervatory.

Lat. of *Philadelphia* Obſervatory.

" THE

duced from the two foregoing correſponding obſervations, than on the *mean* deduced from the calculated times; which, however, puts us only 3″ more weſt. The immerſion of *April* 12th was taken at *Greenwich*, with *Bird*'s Teleſcope of 3,8 inches aperture, and the ſame immerſion at *Norriton* with a Refractor that, in all trials, as near as can be judged, gives the ſame ſecond with the Gregorian Reflector of 4, 4 inches aperture; ſo that 2″ or 3″ might be added to the time of the immerſion at *Greenwich* to agree with our Teleſcope, which would make 5.h 1′. 33″ or 34.″ diff. long. the ſame as got from the *mean* of the calculated times.

The eclipſes of 2d. and 3d. ſatellite are not ſet down, as they are not ſo much to be depended on, as thoſe of the 1ſt.

THE difference of the above obſervations is greater than might be wiſhed. All that can be offered to excuſe them is the want of better inſtruments; though Mr. *Rittenhouſe* thinks the differences chiefly aroſe from the action of the ſun on the wooden frame which ſupported the quadrant. For he always obſerved that when the ſhutter in the roof was opened, the plummet-wire would, in a minute or two, leave the point, though it had ſtood over it quietly all the forenoon. Yet, notwithſtanding thoſe differences, *a Mean*, from ſo many, may be ſuppoſed very near the truth; ſince, if we leave out that of June 6th, which differs moſt from the others, the mean of the reſt will be but 2″ greater than it is ſet down above.

So far I have given Mr. *Rittenhouſe*'s obſervations, previous and ſubſequent to the *Tranſit*, for aſcertaining the going of his time-piece and fixing the latitude and longitude of the obſervatory, from February 15th to July 8th; by which it will appear what laudable diligence he hath uſed in theſe material articles. He hath taken many more obſervations ſince; but thoſe given above, are judged fully ſufficient to ſhew that both the latitude and longitude of the obſervatory may be * depended on, and alſo the times given on the day of the tranſit.

IT hath been mentioned before, that it was on Thurſday afternoon, June 1ſt, that Mr. Lukens and myſelf arrived at *Norriton*, with a deſign to continue with Mr. Rittenhouſe 'till the tranſit ſhould be over. The proſpect before us was very diſcouraging. That day, and ſeveral preceeding, had been generally overcaſt with clouds, and frequent heavy rains; a thing not very common for ſo long a period at that ſeaſon of the year, in this part of America. But, by one of thoſe ſudden tranſitions, which we often experience here, on Thurſday evening, the weather became perfectly clear, and continued the day following, as well as the day of the *Tranſit*, in ſuch a ſtate of ſerenity, ſplendor of ſunſhine, and purity of atmoſphere, that not the leaſt appearance of a cloud was to be ſeen.

* As the menſuration of the ground between the *Obſervatories* of Philadelphia and Norriton, will give the ſame difference both of longitude and latitude, which was got by the different aſtronomical obſervations at each place, they may be therefore taken as a confirmation of each other.

JUNE 2d, and the forenoon of June 3d, were ſpent in making the neceſſary preparations, ſuch as examining and marking the foci of our ſeveral teleſcopes, particularly the reflector, with and without the micrometer. The reflector was alſo placed on a polar axis, and ſuch ſupports contrived for reſting the ends of the refractors, as might give them a motion as nearly parallel to the equator as ſuch haſty preparations would admit. Several diameters of the Sun were taken, and the micrometer examined by ſuch other methods as the ſhortneſs of the time would allow.

THE Sun was ſo intenſely bright on the Day of the Tranſit; that inſtead of uſing the coloured glaſſes ſent from *England* with the Reflector, I put on a deeply-ſmoaked glaſs prepared by Mr. *Lukens*, which gave a much more beautiful, natural and well-defined appearance of the Sun's Diſk. The ſmoaked glaſs was faſtened on the Eye Tube with a little bees-wax, and there was no occaſion to change it during the whole day, as there was not the leaſt cloud, or intermiſſion of the Sun's ſplendor.

MR. *Rittenhouſe*, in his previous projection (ſee p. 4) had made the firſt external contact to be, *June* 3d, $2^h.\ 11'$ for lat. 40° N. and long. $5^h.$ W. of *Greenwich*; on a ſuppoſition of the Sun's horizontal parallax being $8''$. He happened to be very near the truth. For at $2^h.\ 10'\ 33''$ mean time, the 1ſt external *contact* was at *Norriton*, lat. $40°.\ 9'.\ 56$ N. and long. $5^h.\ 1'.\ 31''$ weſt. Other calculations made it generally from $6'$ to $8'$ later for the ſame latitude and longitude.

THO' this calculation was not given, to be entirely depended on, yet it was ſufficient to make us keep what, in the ſea-phraſe, would be called a *good look-out*; and therefore, at *one o'clock*, we took off the Micrometer, which had been fitted to the Reflector with a power of 95, and adjuſted it to diſtinct viſion, with the * ſame power to obſerve the CONTACTS. And during

* As the two *Refracting Teleſcopes*, uſed by my aſſociates, took into their field but a ſmall part of the Sun's limb, and were difficult to manage on account of their length and the Sun's great altitude, it was thought beſt that I ſhould not uſe the greateſt power of the *Reflector*; that, having a larger field, I might be able to

during the hour that was to intervene from *one* to *two*, we reſolved to keep an alternate watch through the *Reflector*, on that half of the *Sun*'s limb, where *Venus* was certainly expected to touch; while the others, not thus employed, were fixing what more remained to be done, as follows, viz.

FIRST, That each of us might the better exerciſe our own judgment, without being influenced, or thrown into any agitation by the others, it was agreed to tranſact every thing by ſignals, and that one ſhould not know what another was doing. The Situation of the Teleſcopes, the two Refractors being at ſome diſtance *without* the Obſervatory, and the Reflector *within*, favoured this deſign.

SECONDLY, Two perſons, Mr. *Sellers*, one of our Committee, and Mr. *Archibald Mc.Clean*, both well accuſtomed to matters of this kind, were placed at one window of the Obſervatory, to count the clock and take the ſignal from Mr. *Lukens*. Two of Mr. *Rittenhouſe*'s family, whom he hath often employed to count the clock for him in his obſervations, were placed at another window to take his ſignal. My Teleſcope was placed cloſe by the clock, and I was to count its beats, and ſet down my own time.

THESE Preliminaries being ſettled, we prepared at two o'clock to ſit down to our reſpective Teleſcopes; or (I ſhould rather ſay) lie down to the *Refractors*, on account of the Sun's great height.

As there was a large concourſe of the inhabitants of the county, and many from the city, we were apprehenſive that our ſcheme for ſilence might be defeated, by ſome of them ſpeaking, when they ſhould ſee any of the ſignals

to give notice to them, if the CONTACT ſhould happen at any great diſtance from that part of the Sun's limb where it was expected, and which might not be within their field. But, if it ſhould happen near that part, we were to tranſact every thing by ſignals given to the counters at the clock, without the leaſt notice to each other. It was alſo thought beſt that there ſhould be ſome difference in our magnifying powers; and I am well pleaſed that I did not uſe a larger with the Reflector, as the viſion, with the power I uſed, was exquiſitely diſtinct and accurate.

for

for the Contacts; and therefore we found it neceſſary to tell them that the ſucceſs of our obſervation would depend on their keeping a profound ſilence 'till the *Contacts* were over. And to do them juſtice, during the 12 that enſued, there could not have been a more ſolemn pauſe of ſilence and expectation, if each individual had been waiting for the ſentence that was to give him life or death. So regular and quiet was the whole, that, far from hearing a whiſper, or word ſpoken, I did not even hear the feet of the counters, who paſſed behind me from the windows to the clock; and was ſurprized when I turned from my Teleſcope to the clock, to find them all there before me, counting up their ſeconds to an even number; as I imagined, from the deep ſilence, that my aſſociates had yet ſeen nothing of *Venus*.

As the CONTACTS are among the moſt eſſential articles relative to this phænomenon, it is material, before we ſet down the *times*, to give a particular account of the manner in which each obſerver judged of them, and the circumſtances attending them.

Mr. RITTENHOUSE's ACCOUNT of the CONTACTS.

"AT $2^h.\ 11'.\ 39''$ per clock, the Revd. Mr. *Barton* of *Lancaſter*, who aſſiſted me at the Teleſcope, on receiving my ſignal, as had been agreed, inſtantaneouſly communicated it to the counters at the window, by waving a handkerchief; who walking ſoftly to the clock, counting ſeconds as they went along, noted down their times ſeparately, agreeing to the *ſame ſecond*. And three ſeconds ſooner than this, to the beſt of my judgment, was the time when the leaſt impreſſion made by *Venus* on the Sun's limb, could be ſeen by my Teleſcope."

"WHEN the Planet had advanced about one third of its diameter on the Sun, as I was ſteadily viewing its progreſs, my ſight was ſuddenly attracted by a beam of light, which broke through on that ſide of *Venus* yet off the Sun. Its figure was that of a *broad-baſed pyramid*; ſituated at about 40 or 45 degrees on the limb of *Venus*, from a line paſſing through her center

Line Parallel to the Equator

18 · 0′.08

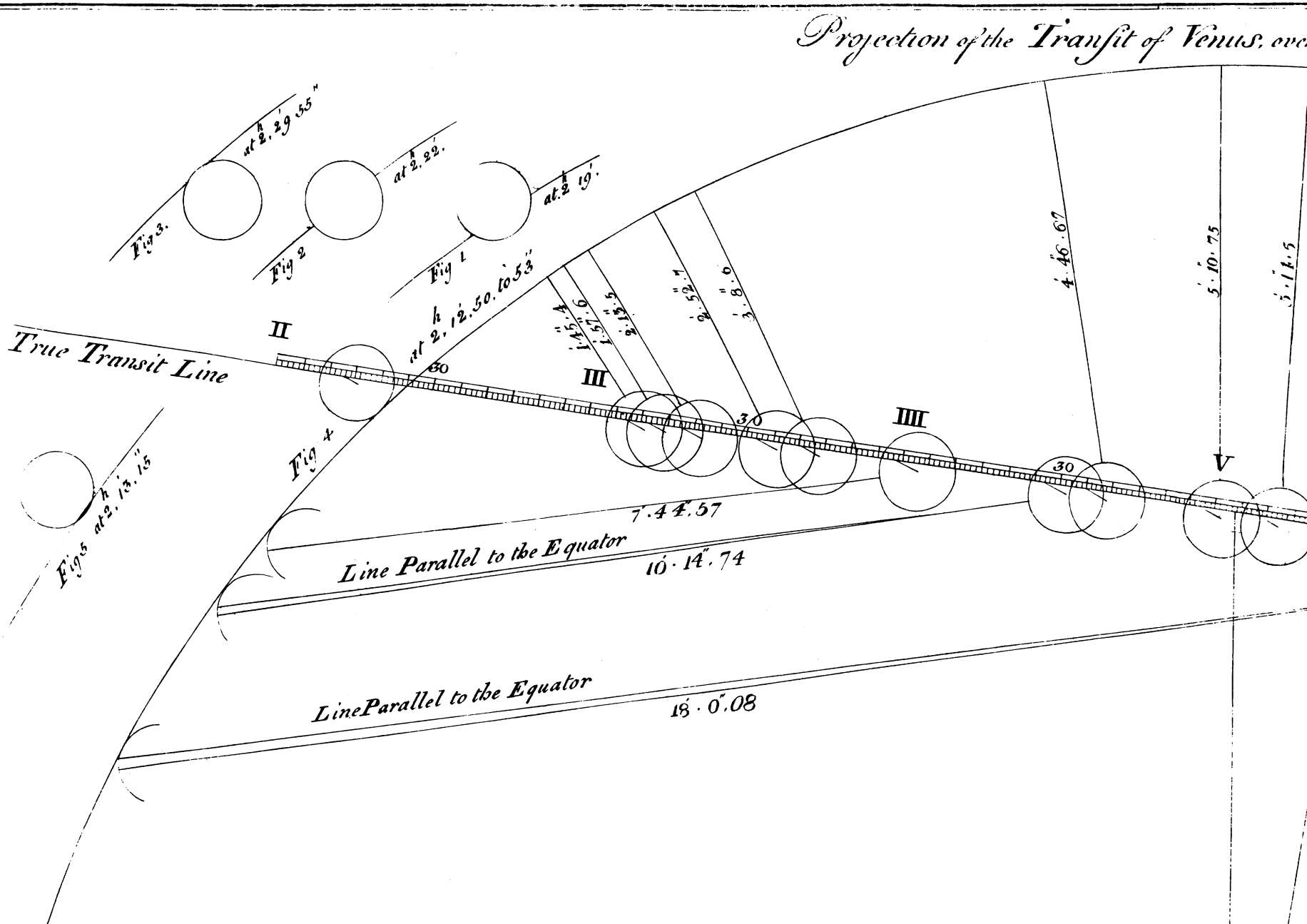
The Phases, Fig. 1. 2. 3. are those noted by M.r Rittenhouse in his Account of the Contacts. Fig. 4. 5. are the Phases noted by D.r Smith in his Account; and Fig 2. 5. are also noted by M.r Lukens.

AB THE

A 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15

Reduced to this Scale by T Smith

Henry Dawkins Sculp

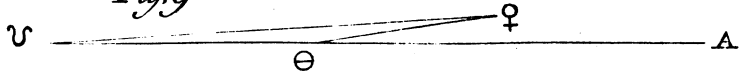

Projection of the Transit of Venus, ove
Fig 3.
at h 2. 29. 55"
Fig 2
at h 2. 22.
Fig 1
at h 2. 19.
at h 2. 12. 50. to 53"
II
III
IIII
V
True Transit Line
30
30
30
Fig 4
h
at 2. 13. 15
Figs at 2. 13. 15
1'. 45". 4
1. 57". 6
2. 13". 5
2. 52". 1
3. 8". 6
4. 46". 67
5. 10". 75
3. 14". 5
7. 44". 57
Line Parallel to the Equator
10. 14". 74
Line Parallel to the Equator
18. 0". 08

VIII

30

30

Fig. 9



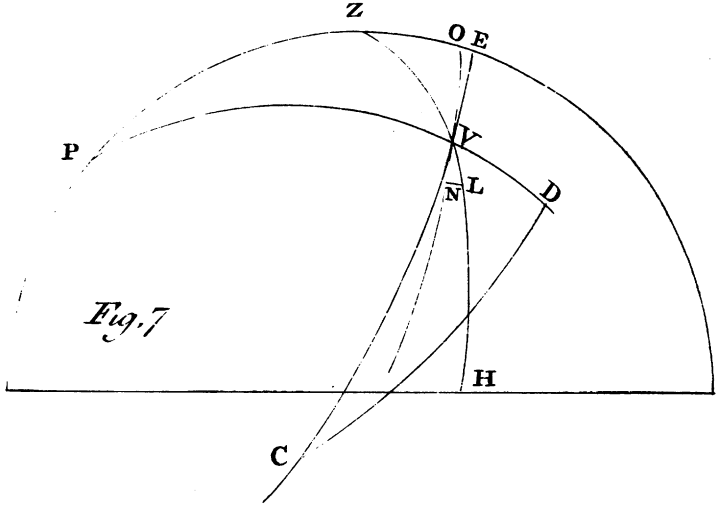


Fig. 7

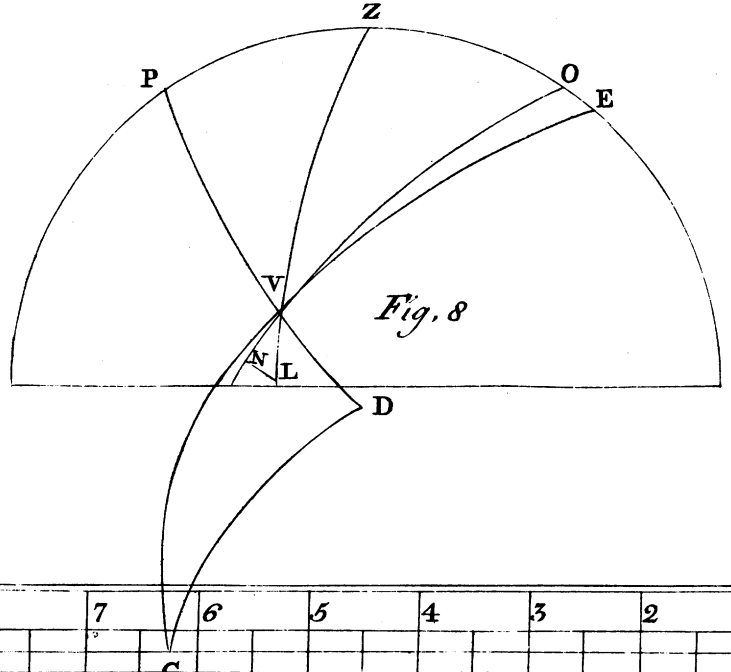


Fig. 8

ECLIPTIC

6 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 B

10 20 30 10 20 30

Hawkins Sculp.t

Delineated by David Rittenhouse, to double the above Scale.

...us, over the Sun, as observed at Norriton in Pennsylvania June 3 1769

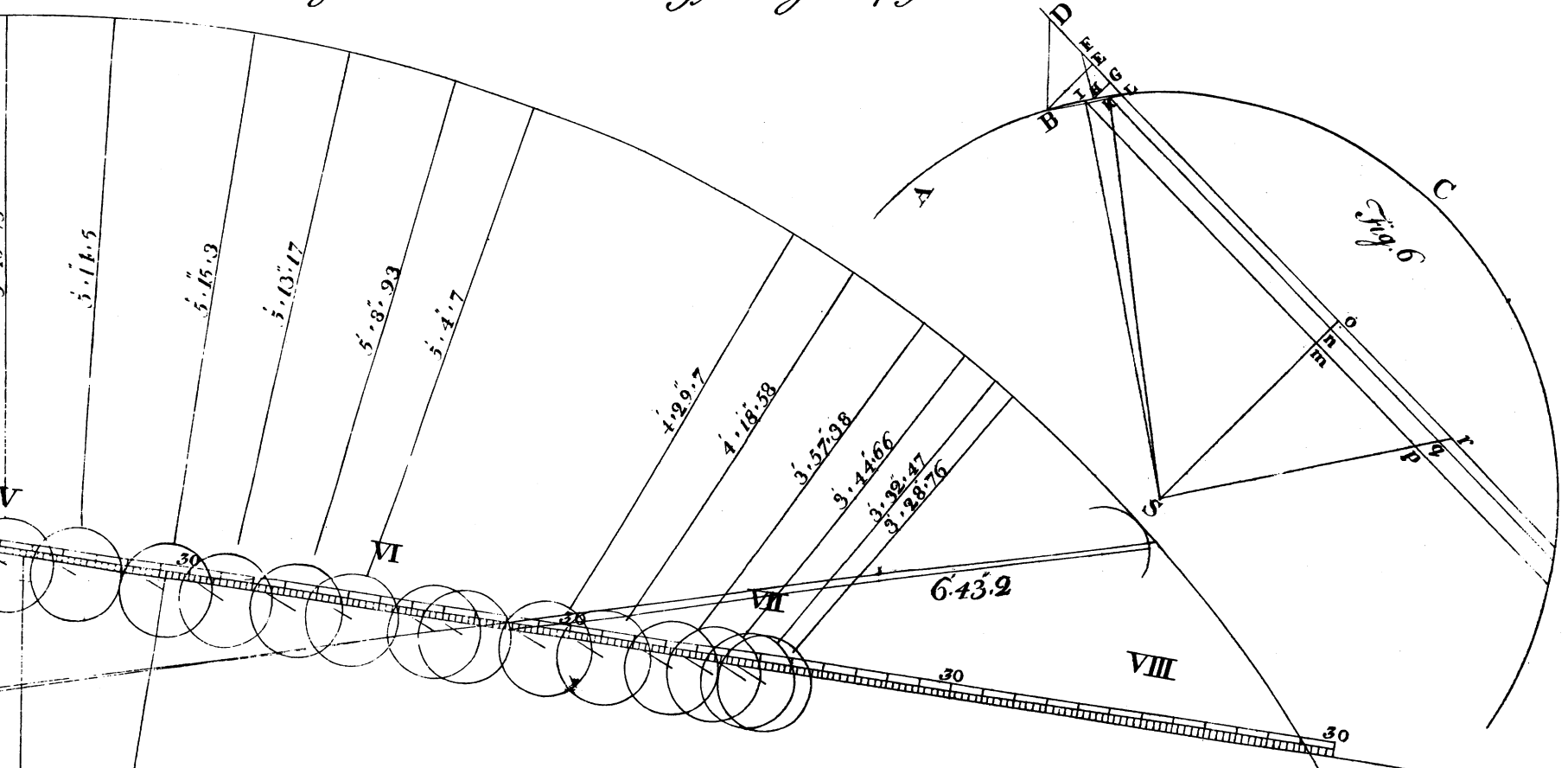
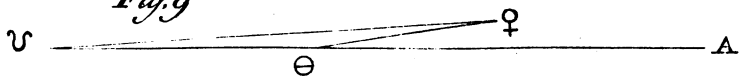


Fig. 9



center and the Sun's, and to the left hand of that line as ſeen through my Teleſcope, which inverted. About the ſame time, the Sun's light began to ſpread round *Venus* on each ſide, from the points where their limbs interſected each other." See a repreſentation of both theſe phænomena, plate 3. fig. 1.

" As *Venus* advanced, the point of the Pyramid ſtill grew lower, and its circular Baſe wider, until it met the light which crept round from the points of interſection of the two limbs; ſo that when half the planet appeared on the Sun, the other half yet off the Sun was entirely ſurrounded by a ſemicircular light, beſt defined on the ſide next to the body of *Venus*, which continually grew brighter, till the time of the internal contact." See plate 3. fig. 2.

" IMAGINATION cannot form any thing more beautifully ſerene and quiet, than was the air during the whole time; nor did I ever ſee the Sun's limb more perfectly defined, or more free from any tremulous motion; to which his great altitude undoubtedly contributed much."

" WHEN the *internal contact* (as it is called) drew nigh, I foreſaw that it would be very difficult to fix the time with any certainty, on account of the great breadth and brightneſs of the light which ſurrounded that part of *Venus* yet off the Sun. After ſome conſideration, I reſolved to judge as well as I could of the co-incidence of the limbs; and accordingly gave the ſignal for the *internal contact*, at $2^h.\ 28'\ 45''$ by the clock (when the appearance of *Venus* and the border of light were as in fig. 3. plate 3.) and immediately began to count ſeconds, which any one, who has been accuſtomed to it, may do for a minute or two, pretty near the truth. In this manner I counted no leſs than $1'\ 32''$ * before the effect of the at-

* MR. *Rittenhouſe* thinks that a perſon who had ſeen the Sun nearer the horizon, and could not ſo well diſtinguiſh between the body of Venus, and this ſurrounding atmoſphere, would have been near 1 later than him in pronouncing the contact; and that the other 32″ elapſed before the Sun's limb (through the large Refractor he uſed) appeared totally reſtored to its former ſplendor.

moſphere

moſphere of *Venus* on the Sun's limb wholly diſappeared; leaving that part of the limb as well defined as the reſt. From this I concluded that I had given the ſignal for the *internal contact* too ſoon; and the times given by the other obſervers at *Norriton* confirm me in this opinion."

Mr. LUKENS's Account of the Contacts.

"The Teleſcope I uſed, being a Refractor of 42 feet, giving but a ſmall field, and ſomething difficult to manage, by reaſon of the Sun's great altitude; I was obliged to move * often, and apprehend that I did not diſcover the firſt impreſſion of the planet on the Sun, which my Teleſcope would have ſhewn. For, after one of thoſe movements, on bringing the glaſs to bear again on that part of the Sun's limb where Venus was expected, I ſaw a large tremulous ſhadow, already ſomewhat advanced, and ſeeming to preſs ſtill inwards on the Sun's limb. Having contemplated this for a few ſeconds, and perceiving the appearance grow more dark, and make a better defined impreſſion on the limb, I gave the ſignal to the perſons who counted time for me, which they noted down ſeparately at $2^h.\ 12'\ 3''$ by the clock. I ſuppoſe my teleſcope might have ſhewn the impreſſion on the Sun's limb at leaſt $15''$ ſooner.

"When Venus was near one half of her diameter advanced on the Sun, I ſaw diſtinctly a border of light encompaſſing that part of her which was yet off the Sun. This was ſo bright that it rendered that part of Venus viſible and pretty well defined, although not yet entered on the Sun. But towards the *internal contact*, the circular border of light ſeemed to grow more duſky towards the points where the luminous ſegments of the Sun's limb were ready to cloſe round the planet. This duſkineſs did not ſeem to part wholly from the Sun's limb, at the time I apprehended the body of Venus to be wholly entered on the Sun, and when I gave the ſignal for the internal contact, which was noted by both the perſons who counted for me at $2^h.\ 28'.\ 58''$ by the clock. And I judge at leaſt from $16''$ to $18''$ more, before I ſaw the Sun's limb clear of this duſky ſhadow."

* The obſervers with the *Refractors* were obliged to lie on the ground, with their heads bolſter'd up by the perſons that aſſiſted them.

Dr.

Dr. SMITH's Account of the Contacts.

"The power kept on the *Gregorian Reflector*, for obſerving the *contacts*, as hath been already obſerved, was the ſame which we had been uſing, and were again to uſe, with the *Micrometer*, magnifying 95 times. I had therefore a large field, taking in about half the Sun's Diſk; and the inſtrument was ſo firmly ſupported, with its axis in a polar direction, that it could not be ſhaken by any motion on the earthen floor of the obſervatory, and required only an eaſy movement of one part of the rack-work to manage it. With theſe advantages, any part of the Sun's limb could be readily kept in the middle of the field, without neglecting, every 4″ or 5″, to caſt my eye on all other parts of the limb on both ſides, where there was any poſſibility of the contact to happen.

Within half a minute of the time calculated for the 1ſt contact by Mr. Rittenhouſe, I ſpoke to the counters at the windows to be very attentive to thoſe who were to give them the ſignals from the Teleſcopes out of doors; and turning my eye cloſely to the part of the Sun's limb where Venus was expected, I had viewed it ſtedfaſtly for ſeveral ſeconds, without having occaſion to change my field, when I was ſuddenly ſurprized with ſomething ſtriking into it, like a watery pointed ſhadow, appearing to give a tremulous motion to all that part of the limb, although the Teleſcope ſtood quite firm, and not the leaſt diſturbance or undulation were perceptible about any other part.

"The idea I had formed of the *contact* was---That Venus would inſtantaneouſly make a well defined black and ſmall impreſſion or dent on the Sun. But this appearance was ſo different, the diſturbance on the limb ſo ill-defined, undulatory, pointed, wateriſh, and occupying a larger ſpace than I expected, that I was held in a ſuſpenſe of 5″ or 6″ to examine whether it might not be ſome ſkirt of a watery flying cloud.

"Perceiving this ſhadow (atmoſphere, or whatever elſe it was) to preſs ſtill forward on the limb, with the ſame tremulous pointed appearance, the longeſt points towards the

middle, I began to count the beats of the clock for either 15″ or 16″, when a well-defined black dent, apparently occupying a leſs ſpace on the Sun's limb, became diſtinctly viſible. I then quitted the Teleſcope and turning to the clock, noted the time it then ſhewed, which was 2ʰ. 12′ 5″.

" About 22″ ſooner than this (viz. the 16″ I counted, and the 5″ or 6″ in which I remained in doubt at the beginning) was the firſt viſible impreſſion on the limb which my Teleſcope would ſhew; and I alſo marked that time down; viz. 2ʰ. 11′ 40″ to 43″. If this firſt impreſſion is to be taken for the *external contact*, I think it may be judged of almoſt to a *ſingle ſecond*, by perſons having equally good eyes and Teleſcopes; which cannot be done, as I apprehend, to *ſeveral ſeconds*, either with reſpect to the *internal contact*, or even with reſpect to the moment of the firſt diſtinct black dent, commonly marked for the *external contact*. In both theſe, ſome differences may well happen among the beſt obſervers, from their different manner of judging, in reſpect to a circumſtance of ſuch exquiſite nicety.

" Whether a Teleſcope of larger powers than what I made uſe of, might not have ſooner ſhewn this firſt ſhadowy impreſſion (that preceeded the diſtinct black contact) I will not take upon me to determine; though, from the time given by Mr. *Rittenhouſe*, I think it would. But this I can be ſure of, that I ſaw the firſt ſtroke of it perceptible through my Teleſcope, having that part of the Sun's limb in full and ſteady view; and I might have noted the time to a ſingle ſecond, if I had expected it in that way.

" As to the *internal contact*, the thread or creſcent of light, coming round from both ſides of the Sun's limb, did not cloſe inſtantaneouſly about the dark body of the planet, but with an uncertainty of ſeveral ſeconds; the points of the threads darting backwards and forwards into each other, in a quivering manner, for ſome ſpace of time, before they finally adhered. The inſtant of this *adheſion*, I determined to wait for, with all the attention in my power, and to note it down for the *internal contact*; which I did, at 2ʰ. 29′ 5″ by the clock; a few ſeconds later than

Mr.

Mr. *Lukens*, who judged in the ſame way. And even then, though the points of the thread of light ſeemed to cloſe, yet the light itſelf did not appear perfect on that part of the limb till about 12″ afterwards; and I apprehend that a perſon who had waited for the perfection of this ſmall thread of light, would have given the contact that number of ſeconds later than I did, although I was later than the others."

"AFTER the 1ſt contact, having quitted the Teleſcope, to note down my time, the gentlemen who counted for us, and ſeveral others now in the obſervatory, were impatient to ſee Venus before ſhe had wholly entered on the Sun; an indulgence not to be denied them, as the Reflector was moſt convenient for them. For this reaſon I did not ſit down to it again till within 5′ or 6′ of the internal contact, and conſequently ſaw none of thoſe curious appearances, on that part of the planet off the Sun, mentioned by my aſſociates. But their account may be fully depended on, as both of them are well accuſtomed to celeſtial obſervations, and are accurate in judgment as well as ſight. The ſmall differences in the times of our *contacts*, it is preſumed, may be eaſily reconciled, from the different powers of our Teleſcopes, and other circumſtances mentioned in the manner of judging. At any rate, we have ſet them down faithfully.

"As to the firſt diſturbance in the Sun's limb, it may be worthy of conſideration, whether it was really from the interpoſition of the limb of *Venus*, or of her atmoſphere. One cannot eaſily imagine it to be the former, without ſuppoſing her limb and body much more ragged and uneven, than they appear when ſeen on the Sun. An atmoſphere is a much more probable ſuppoſition, not only from the faint and wateriſh colour at firſt, but the undulatory motion above mentioned, which might ariſe from the growing denſity of the atmoſphere, puſhing forward on the Sun, and varying the *Refraction* of his rays, as they paſs in ſucceſſion through it.

"IF ſuch an atmoſphere be granted, it will probably account for the tremulous motion, in the thread of light creeping round Venus at the *internal contact*; which may be thus prevented from cloſing and adhering quietly, till this atmoſphere

(or at leaſt its denſeſt part) has entered wholly on the Sun, and conſequently the co-incidence of the limbs be paſt. For, though the atmoſphere of Venus (as far as we could poſſibly judge) be not viſible on the Sun; yet that part of it which is ſurrounding, or juſt entering, his limb, may be viſible; having, if I may ſo expreſs it, a darker ground behind it.

"But theſe are only haſty conjectures, ſubmitted to others; although, if they have any foundation, it would make ſome difference in the time eſtimated between the *contacts*. And therefore, thoſe aſtronomers who may happen to be in the world at *another tranſit*, will perhaps think it beſt to fix on ſome general mode of pronouncing with reſpect to the *contacts*; either by neglecting this atmoſphere altogether, or taking their time from the appearance and diſappearance of its effects on the Sun's limb. In either caſe, it is preſumed the times of different obſervers having nearly the ſame altitude of the Sun, and equal advantages of weather and inſtruments, would not differ ſo much as has been the caſe hitherto, even among eminent aſtronomers at the ſame place."

General TABLE *of the* CONTACTS *of the Limbs of the* SUN *and* VENUS, *as obſerved at Norriton, June 3d,* 1769. *Reduced to apparent Time.*

N B. June 3d, (by the preceeding tables of the work) the Sun's center was on the meridian at 11h. 58′. 49″ by the clock; and June 4th, at 11h. 59′.. 2″ and therefore gained at the rate of 13″ in 24 hours. Hence, at noon June 3d, the clock being 1′. 11″ ſlow of apparent time, ſhe was only 1′. 9″. 48‴ ſlow at the external contact, and 1′ 9″. 40‴ ſlow at the internal contact. But to avoid fractions, we ſay, 1′. 10″ ſlow at both contacts. Whence----

The apparent Time of the Contacts, by the different Obſervers, was——

External Contact, by Dr. SMITH.	External Contact, by Mr. LUKENS.	External Contact, by Mr. RITTENHOUSE.
Firſt viſible impreſſion on ☉'s limb, in form of a tremulous pointed ſhadow, at h. m. ſec. 2. 12. 50 to 53	Mr. Lukens changing his Field.	Firſt impreſſion on ☉'s limb, judg'd of as in Plate 3. Fig. 1. at h. m. ſec. 2. 12. 49
A well-defined black dent in ☉'s limb, at 2. 13. 15	A ſmall Dent in ☉'s limb, at h. m ſec. 2. 13. 13	
Internal Contact.	**Internal Contact.**	**Internal Contact.**
A thread of light, cloſing round the dark body of ♀ with a tremulous motion, at h. m. ſec. 2. 30. 15	Thread of light beginning to cloſe round ♀ at h. m. ſec. 2. 30. 8	Appearance as in Plate 3, Fig. 3, and judged by him for the Contact, at.. h. m. ſec. 2. 29. 55
The luminous thread become clear and quiet in 12″ more, viz. at 2. 30. 27	Thread of light ſeemed compleat, at 2. 30. 24	

WHEN

When Venus was fully entered on the Sun's limb, and we had compared the different papers on which our contacts were written down, and entered them in our book, we prepared for the Micrometer and other observations.

Those of the Micrometer, reduced to apparent time, are as follow, viz.

No. of Observations.	Apparent time. June 3d, 1769.	Micrometer measures of least distance of nearest limbs of ☉ & ♀	Value of micromet. measures; or least dist. of limbs, in min. & sec. of ☉'s diameter.	Parallaxes of ♀ from ☉ adjusted to the times of the Micrometer measures, in order to the Projection; by Mr. Rittenhouse.		
				In the Vertical.	In Path of ♀	Perpendic to Path.
	H. M. Sec.	Inches. 20ths. 500ths.	m sec.	Seconds.	Seconds.	Seconds.
1	3. 7. 19	0. 4. 0,5	1. 45,4	14,54	13,67	4,94
2	3. 11. 39	0. 4. 12	1. 57,6	14,74	13,88	4,96
3	3. 17. 42	0. 5. 2	2. 13,5	15,09	14,24	5,01
4	3. 32. 3	0. 6. 14	2. 52,7	15,77	14,92	5,13
5	3. 40. 4	0. 7. 4	3. 8,6	16,17	15,32	5,23
6	4. 35. 5	0. 10. 21,5	4. 46,67	18,45	17,45	6,01
7	4. 57. 9	0. 11. 19	5. 10,75	19,02	17,95	6,32
8	5. 7. 49	0. 11. 22,75	5. 14,5	19,5	18,36	6,63
9	5. 21. 40	0. 11. 23,5	5. 15,3	19,88	18,64	6,98
10	5. 31. 46	0. 11. 21,5	5. 13,17	20,12	18,8	7,23
11	5. 42. 38	0. 11. 17,5	5. 8,93	20,36	18,95	7,48
12	5. 51. 10	0. 11. 13,5	5. 4,7	20,52	19,06	7,67
13	6. 22. 14	0. 10. 5,5	4. 29,7	21,00	19,21	8,57
14	6. 31. 5	0. 9. 20	4. 18,58	21,12	19,22	8,82
15	6. 41. 24	0. 9. 0	3. 57,38	21,22	19,15	9,14
16	6. 48. 12	0. 8. 13	3. 44,66	21,26	19,12	9,31
17	6. 53. 30	0. 8. 1,5	3. 32,47	21,28	19,04	9,49
18	6. 56. 22	0. 7. 23	3. 28,76	21,29	19,02	9,56

No. of Observ.	Distance of the Limbs of ☉ and ♀ in Chords parallel to the Equator.			Parallaxes, to the times of the micrometer measures		
	H, m. sec	In. 20ths. 500ths.		M. sec.	Seconds	Seconds	Seconds
1	3. 58. 53	0. 17. 14,3	E. limb	7. 44,57	17,0	16,1	5,40
2	4. 27 18	1. 3. 6	E. limb	10. 14,74	18,16	17,18	5,86
3	6. 4. 27	2. 0. 20	E. limb	18. 0,08	20,75	19,16	8,06
4	6 9. 28	0. 15 6,5	W. limb	6. 43,27	20,81	19,2	8,2

Diameters

Diameters of ☉ June 3, 1769.

Time per clock A. M. h. m. sec.	Micrometer measures. In. 20ths. 500ths.	Value. m. sec.
8. 35. 0	3. 11. 13	31. 34,16
8. 40. 0	3. 11. 16	31. 37,34
8. 45. 0	3. 11. 13	31. 34,16
P. M.		
12. 35. 0	3. 11. 13	31. 34,16
12. 40. 0	3. 11. 12	31. 33,1
Mean of the above 5 horizontal diameters of ☉ - -		31. 34,58
Or leaving out the 2d. which differs moſt from the reſt, & was judged to be taken too large; the mean of the other 4 is		31. 33,89

Diameters of ♀ taken on ☉ June 3d, 1769.

Time per clock. h. m. sec.	Micrometer measures. In. 20ths. 500ths.	Value Sec.
3. 0. 0	0. 2. 4,6	56,75
3. 2. 0	0. 2. 5,0	57,18
3. 4. 0	0 2. 5,25	57,44
4. 15. 0	0. 2. 4,7	56,91
5. 55. 0	0. 2. 4,7	56,91
5. 58. 0	0. 2. 5,33	57,53
Mean of the above 6 for diam. of ♀		57,12

Which gives ☉'s ſemidiameter 15′. 46,″94; that is, *one ſecond* and $\frac{1}{3}$ of a ſecond larger than the diameter given in the nautical almanack for the tranſit day. Yet, Venus's diameter, though taken with the utmoſt care by the ſame Micrometer and at the ſame focus (as the Sun's) comes out about one ſecond leſs than it was expected, being 57,″12 ; or about $\frac{1}{33}$ of ☉'s diameter.

The vertical diameter of ☉ on the ſame day was 31′. 31,″8 at 4h. 40′. *P. M.*

Of the Micrometer meaſures, the 2d, 5th, and 18th diſtance of the neareſt limbs of the *Sun* and *Venus* ; the 1ſt in a chord parallel to the equator, the 1ſt and 6th of the diameters of *Venus* ; and the 1ſt and 4th of the diameters of the *Sun*, were taken by Mr. Rittenhouſe. The 3d and 16th diſtance of the neareſt limbs, the 3d diameter of *Venus* and the 2d of the *Sun*, were taken by Mr. Lukens. All the other Micrometer meaſures were taken by myſelf, while Mr. Rittenhouſe applied himſelf to take the appulſes of the limbs of the *Sun* and center of *Venus* to the croſs hairs of his equal altitude inſtrument, Mr. Lukens writing down the obſervations and their exact time.

The Micrometer meaſures were all ſeparately reduced to their value in minutes and ſeconds by Mr. Rittenhouſe, and by myſelf, making the proper allowance for the error of adjuſt-

ment

ment of the inſtrument. Many more Micrometer meaſures might have been taken; but had we made the intervals between them much ſhorter than 8 or 10 minutes, they would have been of little uſe in the projection, and would have crouded it too much. Nor could we have beſtowed the ſame care in ſetting the inſtrument, reading off the vernier, &c. if a much larger number had been taken.

In order to judge of the error of the Micrometer (if any) Jupiter's diameter was not only taken with it both ways, viz. to the right and to the left, but Mr. Rittenhouſe likewiſe took a *mean* to the right of 10 diameters of a white painted circle about 330 yards diſtant, and alſo a *mean* of as many to the left. This work was performed early in the morning before ſun-riſe; when the air was free from all tremulous motion; and the reſult gave an error of adjuſtment of $1'',12$ to be ſubſtracted from all the micrometer meaſures.

It was once intended ſtill further to confirm the work of the following delineation, by applying the obſervations of the appulſes of the limbs of the *Sun* and center of *Venus*, mentioned to have been taken above. But the lines neceſſary for this, would have confuſed the figure; and the Micrometer obſervations being found ſo exact, any further uſe of the others, than to try how well they would agree, was thought to be needleſs, eſpecial as the fractions of ſeconds in them could not be eſtimated, ſo as to come up to the accuracy of the Micrometer. For this reaſon, they are not ſet down.

Delineation

Delineation of the Tranſit of VENUS *over the* SUN, *according to the foregoing Obſervations, with the principles of the work.*
By Mr. RITTENHOUSE.

"THE Sun's horizontal parallax is aſſumed 8″,65 at his mean diſtance from the earth; from which, and the obſerved leaſt diſtance of the centers of the Sun and Venus, the chord of the tranſit line was laid down. The Sun's ſemidiameter and that of Venus are taken as by the above obſervations. One point in the tranſit line was then fixed by the firſt Micrometer diſtance of the limbs at 3ʰ. 7′ 19″ apparent time. This line was then divided carefully into hours and minutes, ſuppoſing Venus to move 240,″36 over the Sun's Diſk in an hour, according to a calculation I had formerly made from Halley's tables. The place of Venus's center in the tranſit line, was then marked to the times of each of the obſervations; and from thence the apparent place of her center found, by ſetting off the quantity of her parallax from the Sun in its proper direction. About each of the centers ſo found, a circle is deſcribed with the Radius 28″,56. the obſerved ſemidiameter of Venus. Blank lines were next drawn through the Sun's center and the apparent place of the center of Venus; and on theſe the black lines were drawn from the Sun's limb preciſely of ſuch length as we found they ought to be by the Micrometer; ſo that it may be ſeen at once how far they correſpond with each other, by obſerving how much they exceed or fall ſhort of reaching the limb of Venus.

OUT of the 18 Micrometer Obſervations, there is ſo exact a correſpondence among 14 of them, that I am well convinced they may be depended upon. Two of the others, as will appear by the figure, reach about a *ſecona* over the limb of *Venus*; and the other two are ſcarce a *ſecond* ſhort of it. Such ſmall differences might eaſily have happened from the leaſt inaccuray in reading off the time, or the diviſions of the vernier, or from their not being exactly taken in the direction of the neareſt diſtance of the limbs; that is in a line joining the center of the *Sun* and *Venus*.

THE

THE meaſures intended to be taken in chords parallel to the equator, are likewiſe exceeding near the truth, if it be conſidered that in ſetting the Micrometer to that direction, we had only the truth of the polar axis to depend on, which was conſtructed haſtily to anſwer the purpoſe of the Day. Three of theſe meaſures agree well with each other, and with all the other Micrometer Obſervations, on ſuppoſing the chord in which they were taken inclined half a degree to the plane of the equator. The 4th is ſtill more nearly parallel, but diverging ſomething the other way. Theſe chords are delineated in the projection, and ſerve to confirm the other work.

ALL the parallaxes of Venus from the Sun were taken from a projection on a large ſcale of half an inch to a ſecond, and then reduced to the ſcale of this delineation. After calculating ſome of thoſe parallaxes, and finding that thoſe got by the projection came as near thoſe got by calculation, as it was poſſible to lay them down from the ſcale; any further nicety was not thought neceſſary.

The angle of Venus's viſible way with the Ecliptic I find to be	8°. 28′. 27″
The angle of the ecliptic with a parallel of declination at 3^{h}. P.M.	7°. 5′. 13″
Decreaſing 53″ per Hour.	
Latitude of the Obſervatory (as above)	40°. 9′. 56″

HENCE the parallaxes were fitted to each of the Micrometer Obſervations, as laid down above. If a computation be made from the firſt Micrometer Obſervation of the diſtance of the limbs, we ſhall find the time of the leaſt diſtance of the centers of the Sun and Venus as ſeen from the Earth's center to have been - - - - - 5^{h}. 26′. 16″

If a like computation be made from the 16th Obſervation it will be found 5. 26. 21

BY comparing ſome other obſervations with theſe I conclude the time of leaſt diſtance of the centers to have been

5^{h}. 26′. 20″

THEN ſay, as Radius is to the tangent of the angle of *Venus*'s viſible way with the ecliptic; ſo is the leaſt diſtance of the centers, to that portion of the path, intercepted between the place of *Venus* at the time of the leaſt diſtance of the centers, and her place at the time of ecliptic conjunction; that is---

Rad: T. 8°. 28'. 27'' :: 610'' : 90'',88.

But 90'',88 reduced to time is - - $0^h.\ 22'.\ 41''$

Time of leaſt diſtance of centers is - $5.\ 26.\ 20$

Difference of which is the time of ecliptic conjunction $5^h.\ 3'.\ 39''$

Again Rad: ſec. 8°. 28' 27'' :: 610'' : 616'',73; the geocentric latitude of *Venus* at the time of ecliptic conjunction.

From the logarithm of *Venus* geocent. lat. 2. 7900974

Subſtract the diff. of the logarithms of *Venus*'s diſtance from the Earth and from the Sun 0. 4002370

Remains the log. of the heliocentric lat. 2. 3898604 = 4'.5'',39

THEN ſay; as the tangent of the inclination of the orb of *Venus*, is to Radius, ſo is the tangent of her heliocent. lat. to the ſine of her diſtance from the node in the ecliptic; that is---

T. 3°. 23.' 20'': Rad:: T. 4.' 5,''39 : Sine 1°. 9.' 4'' the diſtance from node.

THE *Sun*'s place, by Halley's tables at time of ecliptic conjunction was	$2^s.\ 13°.\ 26'.\ 32''$
Diſtance of the node from the Sun	$0.\ 1.\ 9.\ 4$
The Sum is the place of *Venus*'s aſcending node	$2.\ 14.\ 35.\ 36$
But, by Halley's tables, the place of *Venus* to the above time is only	$8.\ 13.\ 26.\ 22$

That is TEN SECONDS too ſlow.

THUS, Gentlemen, you have a faithful account of our whole work, which we could have wiſhed to have reduced to leſs compaſs. Had our latitude and longitude been previouſly fixed, as they had been at Philadelphia by able mathematicians, a great part of our work might have been ſaved. But we thought it neceſſary (as hath been before hinted) to ſhew that ſuch pains were taken in theſe material articles that they may be

be depended on. And as we were happily favoured at the tranſit, with advantages of weather, and other circumſtances, which cannot have happened to the generality of obſervers in many parts of the world, it was thought we ſhould be more readily excuſed, by men of ſcience, for the inſertion of things that might be ſuperflous, than the omiſſion of the leaſt article material, in the account of a phœnomenon, that will never be obſerved again, by any of the preſent generation of men.

I am,
Gentlemen, with great reſpect,
Your moſt obedient humble ſervant,
WILLIAM SMITH.

Philadelphia, July 19th, 1769.

THE reader is deſired to make the following correction of the equal altitudes of April 11th and 14th, as that part of the work was printed off before the miſtake was diſcovered.

	A. M.	*P. M.*			*A. M.*	*P. M.*	
	h. m. ſec.	h. m. ſec.	Hence appar. noon, per clock. h. m. ſec. 12. 0. 25		h. m. ſec.	h. m. ſec.	Appar. noon per clock. h. m. ſec. 11. 59. 37
April 11th.	8. 30. 32	3. 30. 43		*April* 14th.	8. 25. 42	3. 33. 56	
	8. 33. 28	3. 27. 47			- - -	3. 31. 1	
	8. 34. 53	3. 26. 22			8. 30. 2	3. 29. 37	

which gives 1″. to be ſubtracted from, inſtead of being added to, the obſerved time of the immerſion of 1ſt ſatellite, April 12th, and makes it 11h. 14′. 37″ (as it ſtands corrected in the table of eclipſes of the ſatellites) inſtead of 11h. 14′. 39″, as it would be deduced from the altitudes printed above for April 11th, compared with thoſe of April 14th.

The Emer. of 2d Sat. per Clock, June 7th, is alſo to be read, 8h. 43′. 29″, inſtead of 8h. 23′. 42″.

P. S. As it is hoped that not only this province in general, but likewiſe the Society who ſet on foot, and the honorable Houſe of Aſſembly, who ſo liberally encouraged, the deſign for obſerving the Tranſit here, may derive ſome credit from the laudable ſpirit ſhewn on that occaſion, I ſhall add an extract of a letter from the Revd. Mr. Maſkelyne the Aſtronomer Royal, to ſhew how well our labors have been received at home.

Greenwich, Auguſt 2d, 1769.

SIR,

" I Thank you for the account of the Pennſylvania Obſer-
" vations (of the Tranſit) which ſeem *excellent* and *compleat*,
" and do honor to the gentlemen who made them, and thoſe
" who promoted the undertaking; among whom I reckon
" yourſelf in the firſt place.

" As ſoon as I can ſettle the longitude of their places of
" obſervations, with reſpect to this place, I hope to be able,
" from comparing them with my own, and other European
" obſervations, which I have already received, to find the
" SUN'S PARALLAX, nearer than we could depend on it from
" the *Tranſit* in 1761.

" I DO not yet know whether the Obſervations made by
" Meſſrs. Maſon and Dixon in Pennſylvania will ſuffice to
" ſettle the longitude of Philadelphia, to the exactneſs here
" requiſite. I wiſh, therefore to receive the obſervations of
" the eclipſes of Jupiter's ſatellites, made there in the ſpring
" of this year, of which Dr. *Smith* makes mention. Thoſe
" which have been made here, I have ſet down on the * next
" page, and requeſt you will be pleaſed to ſend them to him,
" with my beſt compliments and congratulations on his and
" his fellow-Obſervers ſucceſsful labors. I wiſh alſo to have
" an acount of the difference of latitude and longitude between
" the *Philadelphia Obſervatory*, and the two other *Obſervatories*
" at *Norriton* and the *Capes of Delaware*; and alſo how much
" the *State-Houſe* ſquare differs from the ſouthermoſt point of
" the city of Philadelphia, to which Meſſrs. Maſon and Dixon
" have referred their obſervations.

" WHEN you receive any further account of the Pennſylva-
" nia Obſervations, promiſed by Dr. Smith, or any other
" American Obſervations, I ſhall be obliged to you for a ſight
" of them.

" I BEG you will accept of the encloſed account of my ob-
" ſervations of the Tranſit, and of the eclipſe of the Sun,

* They are inſerted above at the bottom of Page 21.

" June

" June 3d. You will perceive that ſeveral phœnomena noted " at *Nerriton* agreed with thoſe obſerved here; but they have " further obſerved a curious circumſtance at the firſt entrance " of Venus, which the low altitude of the Sun did not permit " me to obſerve here; as, on the other hand, ſome phæno- " mena were noted here, which they have not taken notice of.

" In a few days I will do myſelf the pleaſure to leave ſome " of my pamphlets with you, which I beg you would ſend to " the Pennſylvania Obſervers, when you have an opportu- " nity.

I am,

S I R,

Your very humble Servant,

NEVIL MASKELYNE."

To the hon. THOMAS PENN, *Eſq*;

THE above letter was occaſioned by a ſhort account I had ſent to Mr. PENN four days after the Tranſit, informing him of the ſucceſs of our obſervations, the times of the contacts, and a few other circumſtances attending them; which he communicated to Mr. Maſkelyne. Since that, Mr. Maſkelyne has received full ſatisfaction on all the points mentioned in his letter, as compleat copies of our different obſervations have been tranſmitted to Dr. Franklin, to communicate to him, and ſuch other aſtronomers as he may think proper among his correſpondents in Europe. The particular circumſtances which I mentioned relative to the firſt entrance of Venus, was the duſky tremulous ſhadow or atmoſphere that ſeemed to precede her body, and the light that ſurrounded that part of her limb not entered on the Sun, which was alſo obſerved by the gentlemen at Philadelphia, and by Mr. Biddle at the Capes. Which of theſe, or whether both, may be the curious circumſtance, or circumſtances, obſerved here, which Mr. Maſkelyne ſays the low altitude of the Sun did not permit him to obſerve, we cannot tell; as his account of the Greenwich Obſervations has not yet come to hand. W. S.

An.